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Validity of Triage Early Warning Score (TEWS) and Pediatric Trauma Score (PTS) in Predicting Mortality in Pediatric Patients with Severe Trauma at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital

Francis Noor Yanong Celeste[1*], Kadek Deddy Ariyanta[2], and I Ketut Sudartana[2]

[1]Department of General Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

[2]Division of Pediatric Surgery, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

[3]Division of Digestive Surgery, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

*Corresponding author details: Francis Noor Yanong Celeste; francisceleste3@outlook.com

ABSTRACT

Introduction: Trauma remains a leading cause of morbidity and mortality in children, highlighting the importance of accurate triage tools for early identification of high-risk patients. The Pediatric Trauma Score (PTS) has long been utilized, and the Triage Early Warning Score (TEWS) has demonstrated good predictive value for mortality in emergency settings; however, its validity in severe pediatric trauma, particularly in Indonesia, remains insufficiently explored. ***Objective:*** This study aimed to compare the validity of TEWS and PTS in predicting mortality among pediatric patients with severe trauma in the Emergency Department (ED) of Prof. Dr. I.G.N.G. Ngoerah Central General Hospital. ***Methods:*** A retrospective observational analytic cohort study was conducted using medical record data from July to December 2023. The sample included 39 pediatric patients (<18 years) with severe trauma (Injury Severity Score >15). Statistical analyses included sensitivity, specificity, positive and negative predictive values, accuracy, Receiver Operating Characteristic (ROC) analysis with area under the curve (AUC), optimal cut-off determination, and correlation testing. ***Results:*** Both TEWS and PTS demonstrated 100% sensitivity for mortality prediction. TEWS showed higher specificity (76% vs 50%), positive likelihood ratio (4.16 vs 2), and overall accuracy (79% vs 56%) compared to PTS. ROC analysis revealed high predictive performance for both scores (AUC TEWS 0.965; PTS 0.982), with no significant difference (p=0.654). Optimal cut-offs were TEWS ≥7 and PTS ≤5.5. TEWS was significantly associated with intensive care requirements (p<0.001), unlike PTS. ***Conclusion:*** TEWS demonstrates superior validity compared to PTS in predicting mortality in pediatric patients with severe trauma.

Keywords: triage early warning score; pediatric trauma score; pediatric trauma; mortality; validity.

INTRODUCTION

Trauma remains one of the leading causes of morbidity and mortality among children worldwide. In the United States alone, more than 10 million children require emergency department (ED) care annually due to injury, and over 10,000 pediatric deaths are attributed to traumatic events each year [1]. Given that trauma contributes substantially to illness and death across pediatric and young adult populations, it represents a major public health and healthcare burden. Consequently, accurate and timely decision-making in both prehospital and in-hospital settings is essential to improve clinical outcomes in pediatric trauma patients. An ideal trauma scoring system should be simple, rapidly applicable, and capable of reliably predicting patient prognosis [2]. Early recognition of patients at risk for clinical deterioration and prompt escalation of care are fundamental elements of high-quality emergency medical services [3].

Despite advances in emergency care, the evaluation and triage of pediatric trauma remain challenging in many healthcare facilities. Triage systems play a

critical role in prioritizing care, particularly through the use of trauma scoring tools, which have been developed and refined over the past four decades. Although these scoring systems demonstrate varying levels of performance, each possesses specific strengths that must be balanced against ease of use and the resources required for implementation [4]. The Pediatric Trauma Score (PTS) is one of the most established pediatric triage tools and has been widely adopted in the United States since its introduction by the American College of Surgeons Committee on Trauma [5]. The Advanced Trauma Life Support (ATLS) guidelines recognize the PTS as a valuable instrument for the initial assessment of injured children. This score integrates anatomical and physiological parameters to assist in triage and injury severity estimation [4,5]. Previous studies have demonstrated the predictive value of the PTS for pediatric trauma mortality, with reported mortality rates of approximately 9% for PTS scores greater than 8 and up to 100% for scores of 0 or lower [6].

However, several investigations have reported inconsistent associations between PTS parameters and patient outcomes. Additional studies have suggested that PTS does not consistently outperform other pediatric trauma scoring systems in predicting prognosis, particularly in cases of polytrauma [6]. These limitations have driven the development of alternative scoring models aimed at improving early risk stratification in the ED. One such model is the Modified Early Warning Score (MEWS), a physiological scoring system based on routinely measured vital signs that has been validated for identifying clinical deterioration in medical patients [7]. Nevertheless, MEWS is primarily designed for non-trauma populations. In response to the need for a more comprehensive triage tool suitable for mixed medical and trauma cases, the South African Cape Triage Group adapted MEWS by incorporating trauma-specific and mobility parameters, resulting in the Triage Early Warning Score (TEWS) [8].

Previous studies have demonstrated that TEWS outperforms MEWS and related derivatives in predicting short- and long-term in-hospital mortality among ED patients [9]. Furthermore, higher TEWS values have been shown to correlate significantly with increased rates of hospitalization and in-hospital mortality [10]. Consistent findings from multiple studies indicate that elevated TEWS scores obtained early during ED admission are associated with worse clinical outcomes, including increased mortality risk and the need for higher levels of care [11,12]. Despite these promising findings, research evaluating the use of TEWS in pediatric trauma populations remains limited, particularly in Indonesia. A reliable and accurate triage system for pediatric emergencies is crucial to support nursing surveillance, facilitate early detection of clinical deterioration, and enable timely communication with physicians. Therefore, this study aims to assess and compare the validity of the Triage Early Warning Score (TEWS) and the Pediatric Trauma Score (PTS) in predicting mortality among pediatric patients with severe trauma.

METHODS

This study employed a retrospective observational analytic design with a single-center cohort approach. The research was conducted at the Medical Records Unit of Prof. Dr. I.G.N.G. Ngoerah Central General Hospital, Denpasar. Medical records of pediatric trauma patients presenting between July and December 2023 were reviewed, with data collection and processing carried out in August 2024. This cross-sectional analysis utilized secondary data extracted from patient medical records.

The study population consisted of pediatric patients aged under 18 years who presented to the emergency department with severe trauma and subsequently received inpatient care. Subjects were selected using a consecutive sampling method based on predefined inclusion and exclusion criteria. All relevant clinical and demographic information was documented using standardized data extraction forms prior to analysis. Inclusion criteria comprised pediatric patients with severe trauma, defined as an Injury Severity Score (ISS) greater than 15, a hospital stay exceeding six hours, and an age below 18 years. Exclusion criteria included incomplete or unclear medical records, referral to another healthcare facility, death on arrival, discharge within 24 hours, or refusal of hospital admission.

The primary dependent variable was in-hospital mortality among pediatric patients with severe trauma (ISS > 15). The ISS was used to quantify injury severity based on the three most severe injuries across six body systems. Independent variables included the Triage Early Warning Score (TEWS) and the Pediatric Trauma Score (PTS). TEWS was calculated using seven physiological parameters: systolic blood pressure, heart rate, respiratory rate, body temperature, level of consciousness, and age, with each parameter scored from 0 to 3 and summed to obtain the total score. The PTS consisted of six parameters: body weight, airway status, systolic blood pressure, mental status, open wounds, and fractures, each scored from 1 to 3, with the total score representing overall injury severity.

Control variables included age, sex, type of trauma, and the presence of comorbid conditions. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software (IBM Corp., Armonk, NY, version 29.0 for macOS). The Chi-square test was used to compare the predictive accuracy of TEWS and PTS in identifying mortality among pediatric patients with severe trauma. Diagnostic validity was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the area under the receiver operating characteristic curve (AUROC). Comparative validity between the two scoring systems was determined based on 95% confidence intervals and corresponding p-values.

RESULTS

Basic Characteristics

The total sample of severe pediatric trauma patients in the Emergency Room of Prof. Dr. I.G.N.G Ngoerah General Hospital was 39 children. The characteristics of the study subjects are presented in Table 1. From the data, it was found that most of the patients were male (71.7%), compared to females (28.3%). The average age of the patients in this study was 12 (±5.3) years. The majority of patients had normal nutritional status (79.4%), while others were malnourished (12.8%), overweight (5%), and obese (2.5%). The average ISS score in patients was 23.4 (±8.3), all of which were included in the criteria for severe trauma. The majority of severe trauma experienced by pediatricians was head injuries (53.8%), followed by burns (20.5%), trauma to the extremities (12.8%), trauma to the thorax (5.1%), trauma to the abdomen (5.1%), and trauma to the spine (2.6%).

TABLE 1: Characteristics of Study Subjects.

Characteristic	Total (n = 39)
Sex [n (%)]	
Male	28 (71.7%)
Female	11 (28.3%)
Age [years; mean ± SD]	12 (±5.3)
Nutritional Status [n (%)]	
Underweight	5 (12.8%)
Normal	31 (79.4%)
Overweight	2 (5.0%)
Obese	1 (2.5%)
Type of Trauma [n (%)]	
Head injury	21 (53.8%)
Thoracic trauma	2 (5.1%)
Abdominal trauma	2 (5.1%)
Spinal injury	1 (2.6%)
Extremity injury	5 (12.8%)
Burns	8 (20.5%)
ISS Score [mean ± SD]	23.4 (±8.3)
Outcome [n (%)]	
Survived	34 (87.2%)
Hospital Admission (n = 39)	
General ward	15 (38.5%)
Intensive Care Unit (ICU)	24 (61.5%)
Surgery required (n = 39)	23 (58.9%)
Mortality (n = 39)	5 (12.8%)
Length of hospital stay (days; mean ± SD)	7.7 (±7.6)

Note: Categorical data are presented as n (%), and numerical data as mean ± SD.

During their hospitalization, 24 (61.5%) of the 39 patients were admitted to intensive care, and 15 (38.5%) were admitted to the ward until the end of their stay. Twenty-three (58.9%) also underwent surgery. Five pediatric patients (12.8%) died due to various late-stage complications. Of these five patients, three had previously undergone surgery, and two had previously been admitted to intensive care. The TEWS and PTS scores for outcomes were not normally distributed ($p<0.05$), so the scores are presented as medians (interquartile ranges) (Table 2). Table 2 shows the TEWS and PTS scores for each outcome. The median TEWS scores for patients undergoing surgery, being admitted to intensive care, and being admitted to the ward were 8, 6, and 5, respectively. Patients treated in intensive care and surgery both had a median PTS score of 8. However, patients treated only in the ward had a slightly higher median PTS score of 9. The median TEWS score in patients who died was 9, while the median PTS score was 3.

TABLE 2: Outcomes and TEWS and PTS Scores.

Outcome	TEWS Score Median (IQR)	PTS Score Median (IQR)
General ward	5.00 (4.00–5.25)	9.00 (7.00–9.00)
Intensive Care Unit	6.00 (4.50–7.00)	8.00 (7.00–9.00)
Surgery	8.00 (6.50–9.00)	8.00 (6.00–9.00)
Death	9.00 (8.00–9.00)	3.00 (3.00–5.00)

Validity of TEWS and PTS Scores

The analysis was conducted to determine the TEWS and PTS scores on the outcome of subjects, whether alive or dead, at 6 hours post-treatment in the ER. Categorical data analysis was performed using the Pearson chi-square to compare outcomes and identify mortality in severe pediatric trauma patients. Note that each score has a different cutoff for predicting severe trauma, which is ≥ 7 for TEWS and ≤ 8 for PTS. The results of the 2x2 crosstabulation showed that there were tables containing numbers less than 5, so the significance of the analysis was determined using Fisher's exact test. The results of the analysis are presented in Tables 3 and 4.

TABLE 3: Analysis of Outcomes Based on TEWS Score.

Parameter	Total (n)	TEWS ≥ 7 (n = 17)	TEWS < 7 (n = 22)	p-value
Hospital Admission (n = 39)				***<0.001****
General ward	15	3 (17%)	12 (54%)	
Intensive Care Unit	24	14 (82%)	10 (45%)	
Surgery (n = 39)	23	6 (35%)	17 (77%)	0.711
Mortality (n = 39)	5	5 (29%)	0 (0%)	0.661

Statistically significant at p < 0.05.

TABLE 4: Analysis of Outcomes Based on PTS Score.

Parameter	Total (n)	PTS > 8 (n = 14)	PTS ≤ 8 (n = 25)	p-value
Hospital Admission (n = 39)				***0.205***
General ward	15	7 (50%)	8 (32%)	
Intensive Care Unit	24	7 (50%)	17 (68%)	
Surgery (n = 39)	23	11 (78%)	12 (48%)	1.000
Mortality (n = 39)	5	0 (0%)	5 (20%)	0.563

Statistically significant at p < 0.05.

The analysis showed a significant association between a TEWS score cutoff of ≥ 7 and determining whether patients were admitted to intensive care versus wards (p<0.001*), but not between the TEWS score and other outcomes (Table 3). Unlike the TEWS, the analysis showed no significant association between a PTS score cutoff of ≤ 8 and various outcomes (Table 4).

Further analysis was performed to determine sensitivity (Sn), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (CFR), negative likelihood ratio (NLR), and accuracy (Ak). Calculations were performed using a 2x2 table, referring to Tables 3 and 4, using a standard formula. The results are shown in Table 5.

TABLE 5: Validity Analysis of TEWS and PTS Scores for Mortality Prediction.

Score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Positive Likelihood Ratio (%)	Negative Likelihood Ratio (%)	Accuracy (%)
TEWS	100	76	38.46	100	4.16	0	79
PTS	100	50	22.72	100	2	0	56

Table 5 shows that TEWS has the same high sensitivity as PTS and a higher specificity than PTS, consistent with the CFR value of 4.16%. In addition, the TEWS score has higher accuracy compared to the PTS score, meaning that the ability to assess mortality in severe pediatric trauma patients using TEWS is better when compared to the PTS score.

Optimal Cutoff and Area Under the Receiver Operator Curve (AUROC) for TEWS and PTS

The optimal cutoff value for the TEWS and PTS scores in this study will be statistically analyzed by finding the intersection point between sensitivity and specificity by exploring the area under the curve (AUC) and determining the coordinates of the receiver operator (ROC) curve. An AUC value below 0.5 is considered the worst, and a value closest to 1 is considered the best. The ROC curve for the TEWS score in this study can be seen in Figure 1.

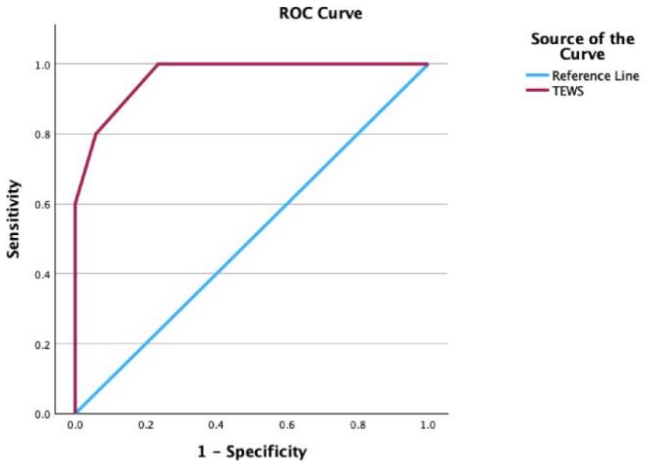

FIGURE 1: ROC curve of TEWS score.

The analysis results show that the AUC value for this particular logistic regression model is 0.965, indicating that the model is capable of predicting mortality from severe pediatric trauma well. The cutoff point for the diagnostic test was statistically determined using the ROC coordinate procedure, as shown in Table 6. Furthermore, the analysis showed that a TEWS score cutoff of 6.5 achieved 100% sensitivity and 76.5% specificity.

TABLE 6: TEWS Cut-off Points for Mortality Prediction.

Positive if ≥	Sensitivity (%)	1 – Specificity (%)
2.0	100	100
3.5	100	97.1
4.5	100	67.6
5.5	100	44.1
6.5	100	23.5
7.5	80	5.9
8.5	60	0
9.5	20	0
11	0	0

This analysis indicates that a TEWS score cutoff of ≥6.5 has higher specificity than a cutoff of ≥7. Thus, it can be concluded that using a cutoff of ≥7 is accurate in determining mortality in severe pediatric trauma, considering the integer value of the TEWS score. The PTS score and mortality outcomes have an inverse relationship, meaning that higher classifier scores correspond to more negative outcomes (live = 1, die = 2), while lower PTS scores correspond to lower outcomes (best = 12, worst = -6). In such cases, the ROC curve appears "inverted," or the AUC is low (even below 0.5). The ROC curve for the PTS score in this study can be seen in Figure 2. The analysis results show that the AUROC value for this particular logistic regression model is 0.982, which is closer to 1 than the ROC curve for the TEWS score.

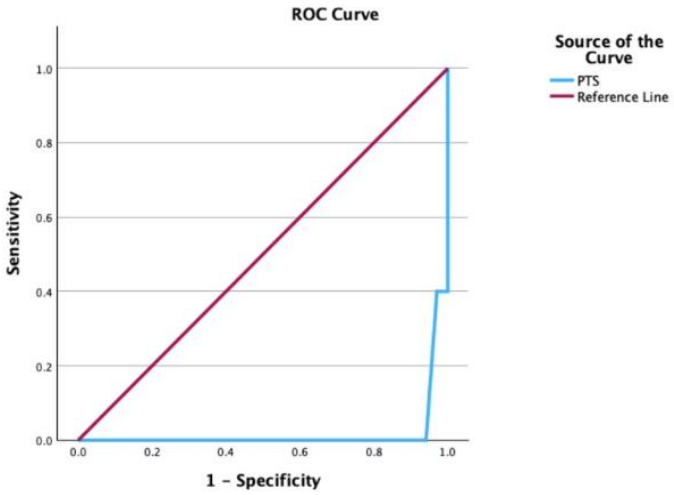

FIGURE 2: ROC curve of the PTS score.

This means that a higher PTS AUROC indicates that, overall, the PTS has better discriminatory ability than the TEWS. This means that, across all possible cutoff points, the PTS is generally better at distinguishing between patients who will die and those who will not. The cutoff points for the diagnostic test were statistically determined using the ROC coordinates procedure, as shown in Table 7. Analysis of the ROC cutoff points for the PTS transformation score showed that a PTS transformation score cutoff of 5.5 achieved 100% sensitivity and 94.1% specificity. These results indicate that a PTS score cutoff of 5.5 or higher has higher specificity than a cutoff of 8 or higher. Figure 3 shows that the TEWS score has an AUROC of 96.5%, while the PTS score has an AUROC of 98.2%. The difference between the two areas is 1.7%, with a p-value of 0.654, which is not statistically significant.

TABLE 7: PTS Score Cut-off Points.

Positive if ≤	Sensitivity (%)	1 – Specificity (%)
11.0	100	100
9.5	100	91.2
8.5	100	50.0
7.5	100	26.5
6.5	100	20.6
5.5	100	5.9
4.5	60	2.9
3.5	60	0
2.0	0	0

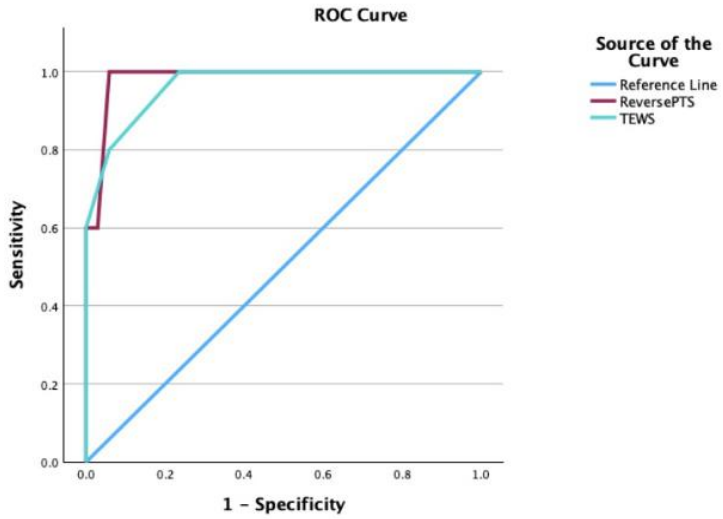

FIGURE 3: ROC curve of TEWS and PTS scores.

DISCUSSION

Baseline Characteristics of the Study Population

This study successfully included 39 pediatric patients with severe traumatic injuries. Analysis of baseline characteristics demonstrated a predominance of male patients, with a mean age of 12 years (±5.3). Most participants (79.4%) had a normal nutritional status. The mean Injury Severity Score (ISS) was 23.4 (±8.3), confirming that all subjects met the criteria for severe trauma. Head injury constituted the most common mechanism of severe trauma (53.8%), followed by burn injuries (20.5%), extremity trauma (12.8%), thoracic trauma (5.1%), abdominal trauma (5.1%), and spinal injuries (2.6%). During hospitalization, 48.7% of patients required intensive care unit (ICU) admission, while the remaining 51.3% were managed in general wards. Surgical intervention was performed in 58.9% of cases.

Overall mortality occurred in five pediatric patients (12.8%), primarily due to late-stage complications. Among these deceased patients, three had undergone surgical procedures, and two of them required ICU care. The median TEWS scores among patients undergoing surgery, ICU admission, and ward care were 8, 6, and 5, respectively. Patients admitted to the ICU and those undergoing surgery had a median PTS score of 8, whereas patients treated exclusively in the ward demonstrated a slightly higher median PTS score of 9. Notably, deceased patients had a median TEWS score of 9 and a median PTS score of 3, indicating greater physiological instability and injury severity in this subgroup.

Validity of TEWS and PTS Scores

Triage systems play a critical role in addressing limitations in healthcare resources by facilitating the identification of patients with the most urgent needs and highest risk profiles. Prior studies have demonstrated that the implementation of triage systems in acute care settings within low- and middle-income countries is associated with reduced treatment delays and mortality rates.[13,14]. Trauma remains a leading cause of morbidity and mortality among children, with more than 10 million pediatric emergency visits and over 10,000 deaths annually in the United States alone. Given this substantial burden, accurate triage and appropriate early management are essential to improve outcomes in pediatric trauma patients. An optimal trauma scoring system should be simple, rapid, and capable of accurately predicting patient outcomes [1].

The Pediatric Trauma Score (PTS) has long been recognized and widely utilized in the United States as a pediatric trauma triage tool. It evaluates combined anatomical and physiological parameters

and has demonstrated validity in predicting mortality among injured children. However, several studies have reported inconsistent prognostic performance of the PTS, leading to the development of alternative scoring systems [15]. Conversely, the Modified Early Warning Score (MEWS) is a physiological scoring system designed to identify patients at risk of clinical deterioration. Its adaptation into the Triage Early Warning Score (TEWS) has shown superior predictive performance for mortality in emergency department settings and has been associated with improved identification of patients requiring hospitalization and at increased risk of death [16].

Although the predictive validity of TEWS has been examined in multiple studies, its application in pediatric populations remains limited, particularly in Indonesia. Accurate triage systems are crucial for detecting pediatric emergencies in the emergency department, enabling timely intervention and prompt communication with physicians [16–18]. Accordingly, this study aimed to evaluate the validity of TEWS and PTS in predicting mortality among pediatric patients with severe trauma. The present findings demonstrated that mortality prediction using a PTS cutoff ≤8 was 23%, with a median score of 3, whereas a TEWS cutoff ≥7 yielded a mortality prediction of 38%, with a median score of 9.

Statistical analysis revealed a significant association between TEWS ≥7 and type of hospital admission (ICU versus ward) ($p < 0.001$), whereas no significant association was observed for PTS ≤8 with any clinical outcomes. Although TEWS and PTS have not previously been directly compared, several studies have reported mortality outcomes associated with each score independently. PTS was originally developed by Tepas et al. in 1987 as part of the Advanced Trauma Life Support (ATLS) framework and consists of six parameters, with scores ≤8 indicating severe trauma [1,19]. Based on this threshold, patients are categorized into significant trauma (PTS ≤8) and non-significant trauma (PTS >8) groups [2].

Previous studies have evaluated the impact of this cutoff on patient outcomes. Balik et al. (2004) reported a mortality rate of 14.7% among patients with PTS ≤8 and observed a mean PTS score of 5.1±3.1 among deceased patients. Anıl et al. (2017) similarly reported that all mortalities occurred in patients with PTS ≤8. The slightly lower median PTS observed in the present study may be attributable to differences in trauma mechanisms among study populations [2]. Several investigations have also examined TEWS using thresholds of ≥7 to define high-risk patients. In a study of 590 patients, 32 individuals had TEWS ≥7, of whom eight died, with a mean score of 9.5 among deceased patients [10]. Another study in patients with COVID-19 reported a median TEWS of 11.5 among patients who died within 24 hours [20]. Although no studies have specifically evaluated TEWS scores during the first six hours of ED care, the findings of this study support the potential utility of TEWS in early ED triage.

Anıl et al. (2017) also noted that PTS ≤8 was more frequently observed among patients requiring critical interventions, ICU admission, ventilation, and surgical procedures. In contrast, the present study found that most ICU patients had a PTS score of 8 [2]. While this cutoff may still be useful for identifying patients requiring intensive care, further validation is necessary. For TEWS, previous studies reported that most ICU admissions occurred among patients with scores <7, whereas the present study identified a median TEWS score of 5 in ICU patients, which may explain the absence of a statistically significant association in this context. Both TEWS and PTS demonstrated high sensitivity (100%) in this study, as all five deceased patients had PTS ≤8 and TEWS ≥7. However, TEWS exhibited higher specificity than PTS, with a positive likelihood ratio of 4.16%, exceeding that of PTS and previously reported values (2%). These findings suggest that TEWS may offer superior discriminatory ability for predicting mortality in severe pediatric trauma compared to PTS.

Although both scoring systems are designed to rapidly assess patient severity in emergency settings and guide resource allocation, they differ in scope and applicability. TEWS is typically used in adult emergency scenarios to assess overall physiological status, whereas PTS is specifically designed for pediatric trauma and emphasizes injury-related parameters [10]. Nevertheless, PTS does not account for non-traumatic medical conditions, whereas TEWS incorporates broader physiological parameters, making it more suitable for identifying clinical deterioration in pediatric patients with both traumatic and non-traumatic emergencies [16].

Additionally, PTS does not fully capture age-related variability in vital signs across pediatric populations and is not designed for continuous monitoring. In contrast, TEWS allows ongoing assessment and may detect early deterioration through changes in consciousness or vital signs [17]. Multicenter studies comparing multiple trauma scoring systems have also suggested that PTS may not be the most accurate predictor of mortality compared to alternatives such as aTRISS [6]. Therefore, while PTS remains valuable for pediatric trauma assessment, TEWS may complement PTS by identifying broader clinical risks that might otherwise be overlooked.

Optimal Cutoff Values and Area Under the Receiver Operating Characteristic Curve (AUROC) of TEWS and PTS

TEWS is one of several early warning scores developed to predict mortality across various levels of healthcare. The validity of TEWS and similar scoring systems has been explored in multiple studies, each highlighting their predictive strengths and limitations. In this study, TEWS demonstrated an AUROC value of 0.948, indicating excellent discriminatory ability for predicting mortality in severe pediatric trauma.

Cutoff analysis revealed that a TEWS threshold ≥6.5 achieved 100% sensitivity and 76.5% specificity. Although this cutoff offered higher specificity than ≥7, the use of ≥7 remains clinically practical given the integer-based nature of TEWS scoring.

Previous studies have similarly investigated optimal TEWS thresholds. Tang et al. (2021) reported maximal sensitivity and specificity at a cutoff ≥7, with values of 1.00 and 0.69, respectively [21]. Other studies observed that a proportion of patients with TEWS <7 were hospitalized, possibly due to triage inaccuracies, while some patients with TEWS ≥7 were discharged, potentially reflecting chronic conditions with altered physiological parameters [18,22,23].

Comparative analyses of MEWS and TEWS have also demonstrated strong predictive performance. Aygun and Eraybar (2022) reported AUROC values of 0.833 for MEWS and 0.823 for TEWS in predicting 28-day mortality [20]. Other studies have shown TEWS AUROC values ranging from 0.801 to 0.906 across different time intervals [10]. In contrast, NEWS and NEWS2 have demonstrated moderate predictive accuracy in various populations [24].

In this study, PTS demonstrated an AUROC of 0.982, slightly higher than that of TEWS, suggesting superior overall discriminative ability. However, the difference between the two AUROC values (1.7%) was not statistically significant (p = 0.654). Cutoff analysis indicated that a PTS ≤5.5 yielded higher specificity than the conventional ≤8 threshold, suggesting that the traditional cutoff may not be optimal. While PTS exhibited higher overall discrimination, its lower specificity at the standard cutoff suggests a greater likelihood of false-positive predictions. This contrasts with TEWS, which was applied using a more optimal threshold. Overall, although both TEWS and PTS provide valuable frameworks for mortality prediction, further refinement and validation are required across diverse clinical settings and populations.

The study also highlights several limitations of TEWS. First, TEWS does not include oxygen saturation or supplemental oxygen use, both of which are critical parameters in ED triage [25]. Studies modifying early warning scores to include oxygen supplementation have demonstrated improved predictive accuracy, as evidenced by increased AUROC values [26]. However, further validation is needed to ensure generalizability across settings. Second, TEWS does not account for inotropic support, which may artificially elevate systolic blood pressure and influence score interpretation [10]. Finally, TEWS may underestimate severity in referred patients whose vital signs have been stabilized prior to transfer. Incorporating referral status as a parameter could provide valuable clinical context and improve triage accuracy.

Study Limitations

This study has several limitations. First, TEWS and PTS were evaluated at a single time point, six hours after emergency department admission, limiting the assessment of their long-term prognostic value. Second, the retrospective design, small sample size, and single-center setting limit the generalizability of the findings. Larger, prospective multicenter studies are required to further validate optimal triage approaches and prognostic tools for pediatric trauma patients in emergency department settings.

CONCLUSION

The Triage Early Warning Score (TEWS) demonstrated superior validity compared to the Pediatric Trauma Score (PTS) in predicting mortality among pediatric patients with severe trauma at Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar. Both scoring systems showed equally high sensitivity (100%) for mortality prediction; however, TEWS exhibited higher specificity, positive likelihood ratio, and overall diagnostic accuracy than PTS. Although no significant difference was observed between TEWS and PTS in terms of mortality outcomes, TEWS was found to be more effective in predicting hospitalization requirements, including the need for intensive care, in patients with severe pediatric trauma. These findings suggest that TEWS may provide greater clinical utility as a triage tool in the emergency department setting for this patient population.

DISCLOSURES

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

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